

New Screw Thread Standards

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ON NOVEMBER 18, 1948, a group of distinguished gentlemen representing governmental bureaus, engineering and standards associations, and industries of Great Britain, Canada, and the United States signed an important document. That document was the Declaration of Accord with respect to the Unification of Screw Threads and is reproduced here (Fig. 1).

Declaration of Accord

with respect to the
Unification of Screw Threads

It is hereby declared that the undersigned, representatives of their Government and Industry Bodies, charged with the development of standards for screw threads, Agree that the standards for the Unified Screw Threads given in the publications of the Committees of the British Standards Institution, Canadian Standards Association, American Standards Association and of the Interdepartmental Screw Thread Committee fulfill all of the basic requirements for general interchangeability of threaded products made in accordance with any of these standards.

The Bodies noted above will maintain continuous cooperation in the further development and extension of these standards.

Signed in Washington, D. C., this 18th day of November, 1948, at the National Bureau of Standards of the United States.

<i>W. H. Jones</i>	Ministry of Trade and Commerce, Dominion of Canada
<i>W. H. Jones</i>	Canadian Standards Association
<i>W. H. Jones</i>	Ministry of Supply, United Kingdom
<i>W. H. Jones</i>	British Standards Institution
<i>W. H. Jones</i>	Representative of British Industry
<i>W. H. Jones</i>	National Bureau of Standards
<i>W. H. Jones</i>	U. S. Department of Commerce
<i>W. H. Jones</i>	Interdepartmental Screw Thread Committee
<i>W. H. Jones</i>	American Standards Association
<i>W. H. Jones</i>	The American Society of Mechanical Engineers
<i>W. H. Jones</i>	Society of Automotive Engineers
<i>W. H. Jones</i>	Sponsors Council of United States and United Kingdom on the Unification of Screw Threads

FIG. 1.

Announcement of the signing was made in a few daily newspapers and national magazines. Since then the public seems to have forgotten it, screws and screw threads apparently being so prosaic as to invite only passing interest. There was nothing about the event to make it as dramatic as nuclear fission, atomic energy, a test for detecting the presence of cancer, or jet propulsion, and yet its effects are momentous.

Screw threads are essential to the mechanisms and structures of our modern technologic society. One has only to think how many objects in his immediate surroundings are held together by bolts, nuts, and screws to realize the great number of industries that are involved. Almost all assembly line and durable goods industries are affected by the new standards.

The first attempt at a standard thread form was made about a hundred years ago by a British tool-maker named Joseph Whitworth. British industry adopted this standard in 1841 or about then and it became known as the British Whitworth Thread. It is distinguished from the thread we have used in this country by its 55° thread angle and its rounded crest and root as shown in the contour sketch, Fig. 2.

In 1864 a Philadelphian by the name of William Sellers urged the Franklin Institute of that city to establish and adopt a different design of thread. A number of contentions were advanced to demonstrate



FIG. 2. Contour of British Whitworth Thread.



FIG. 3. Contour of American National Thread.

why the Sellers thread was a better one for our industry. It was subsequently adopted as the standard for the United States and has been known recently as the American National Thread. It is principally distinguished from the British Whitworth Thread by its 60° thread angle and its flat crest and root as shown in contour in Fig. 3.

It is not necessary to discuss many of the scientific and engineering factors which reacted against each other when an attempt was made to interchange products made in accordance with the two systems. The interference is self-evident in a comparison of Figs. 2 and 3. It is this lack of interchangeability that caused so many difficulties over the years, not only here but in Britain and Canada as well. Canada suffered doubly because its trade and commerce were of such a nature as to require some products to be adaptable to either one of the standards.

It is natural for a group of people to consider its own particular product, principal, or standard to be the best. For years Britain insisted upon requiring the use of a 55° thread and the United States was just as insistent upon a 60° thread. The loss in trade between the two countries, where threads or threaded fasteners were important, has never been measured.

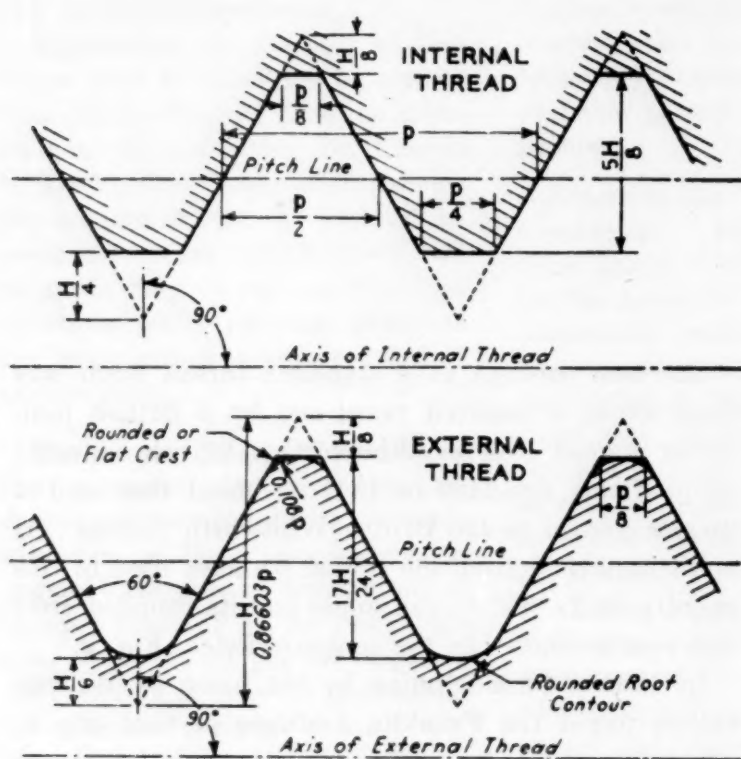


FIG. 4. Unified form of thread (maximum metal condition).

The need for adjusting these differences between the two systems must have been written and talked about almost from the very moment we adopted the Sellers thread. For years, however, nothing much was done about it. It has taken two world wars to bring all parties to the realization that action was necessary.

There are some appalling stories about the loss of time and money incurred by Allied nations because of noninterchangeable screw threads. It has been said that it took us ten months to start manufacture of the British Rolls Royce engine. Supposedly, most of that time was lost because our factories had to be specially set up to produce the British thread. Another story has it that it took six months to adapt the Bofors gun to American manufacture, largely because of thread differences. It has been estimated that the differences between the British and American threads cost the recent war effort no less than a hundred million dollars. That statement, if true, becomes all the more realistic when we think of it in terms of time, effort, and blood. These examples represent a very few of the serious situations which finally brought about the signing of the Declaration of Accord.

In fairness to all concerned, however, we owe a debt of sincere gratitude to the early leaders in the screw thread movement. Those old systems stood the test of time for over 75 years.

In the United States there has been, over the years, a great deal of criticism of our system. In developing the new standards, careful consideration was given to these complaints, and where possible the objectionable features were avoided. The new standards therefore

serve a twofold purpose in providing a unified screw thread, interchangeable among Britain, Canada, and the United States, and in overcoming many of the other objections to the old standards.

It is important to note that these new standards resulted from a cooperative attack on the problem by the three governments, the producers of threaded articles and tools, and the consumers of such articles. All interests were represented. Numerous bodies, such as governmental bureaus and trade associations, other than those specifically mentioned in the Declaration of Accord, have participated over the years in this program.

The new standard is known as the Unified Thread and Fig. 4 indicates its characteristics for both internal and external threads. In comparing Fig. 4 with Figs. 2 and 3 it is immediately evident that the new form is a compromise. Certain characteristics of both the Sellers and the Whitworth forms are evident.

Note that the new thread form does not differ too greatly from the old American National form. The thread angle is the same—60°. The principal difference is at the thread root in the external thread, which is shown rounded rather than flat-bottomed. This round form is not mandatory with new tools. At the crest of the external thread, it will be noted that two forms are shown. One is rounded, which is the form preferred by the British, and will be published in their standards. The other is flat, which is preferred by the United States and will be shown in the American publication.

The various classes of thread provided in the new standards, while similar in form, differ principally by the amount of pitch diameter tolerance and allowance specified. These classes are:

External thread	Internal thread
1A (Allowance)	1B
2A (Allowance)	2B
3A	3B
2	2
3	3

Generally speaking, classes 1A and 1B will find their greatest application in Britain among the so-called black bolt manufacturers. In this country their greatest application will be for ordnance work, plastic molded threads, or die cast threads. Classes 2A and 2B will be the recognized standards for normal production of bolts, nuts, and screws. Classes 3A and 3B are included to provide for close tolerance work. These classes are expected eventually to replace classes 2 and 3, which were the standards largely in use prior to the signing of the Declaration of Accord. These two latter classes are not unified threads, but have been

retained in the standards because of their widespread current usage. They will continue to serve through the difficult transition period from the old to the new standards.

The new standard thread dimensions overcome various faults found in the old system. The old standards took into consideration only one variable—thread pitch. The new standards consider at least two additional variables, namely, basic major diameter and length of engagement.

The tolerances and allowances of the unified threads, classes 1A, 2A, 3A, 1B, 2B, and 3B, are based uniformly upon a new empirical formula. It was developed through a study by fastener manufacturers and represents normal accuracy in present-day threading practice. This formula contains a multiplying factor, C , which is introduced to proportion the formula for the various classes of thread. Inspection of this formula will show that the tolerance or allowance depends upon three variables: the major diameter, length of engagement, and pitch of the thread.

The following formula is applied in setting up allowances on all diameters and tolerances on pitch diameter of the unified classes of threads:

Tolerance (or allowance) =

$$C(0.0015\sqrt[3]{D} + 0.0015\sqrt[3]{Le} + 0.015\sqrt[3]{P^2}).$$

Where C = factor for each allowance or tolerance,

D = basic major diameter,

Le = length of engagement, and

P = pitch.

Class	Factor C	
	For tolerance	For allowance
1A	1.500	0.300
1B	1.950	0.300
2A	1.000	0.300
2B	1.300	0.300
3A	0.750	0.000
3B	0.975	0.000

As the list of class designations shows, there is an allowance in classes 1A and 2A.

For years users of threaded articles have been plagued with the metal-to-metal contact between internal and external threads under the maximum metal conditions permitted in the old standards. The allowance in the new standard is actually a small air gap or neutral clearance between mated internal and external threads, even under maximum metal conditions. This air gap is so small as to have practically no effect upon the strength of mated members, yet it serves a useful purpose. The mass production assembly line industries in particular will be grateful for this allowance. Some of its advantages are:

1. It facilitates high cycle wrenching. In the past it has not been unusual to develop heat through fric-

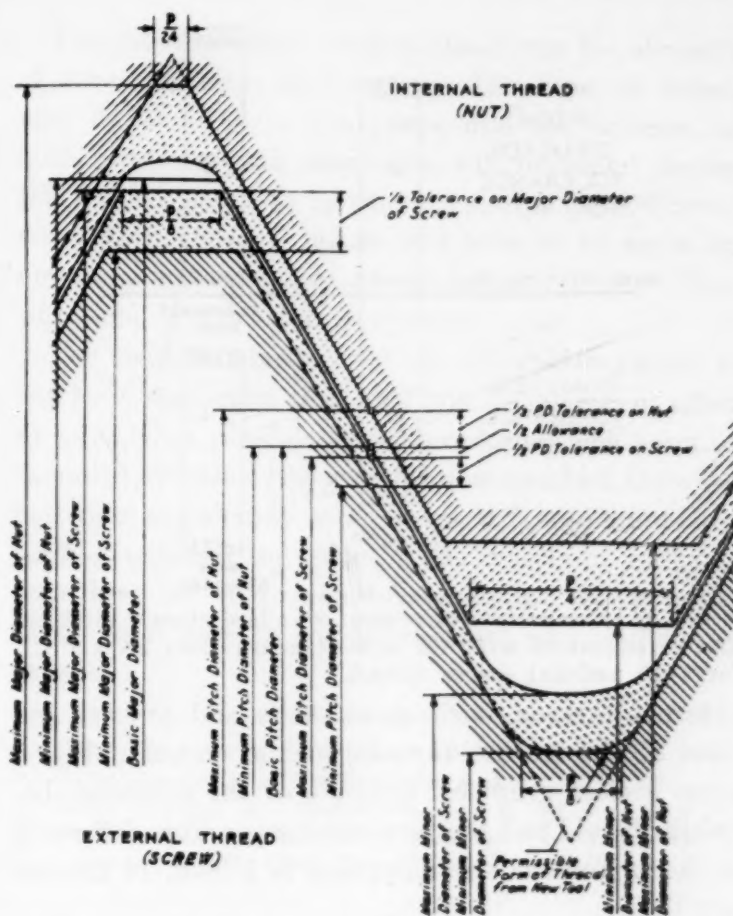


FIG. 5. Tolerances, allowance, and crest clearances for classes 1A, 1B, 2A, and 2B.

tion, when power wrenches are used. This often caused the internal member to expand, and galling and seizure of the threads resulted.

2. The allowance solves the problem of interference between mated members due to plating.

3. Handling of threaded articles, such as bolts, nuts, and screws, occasionally results in the burring and nicking of threads. The producer's plant may contribute a few burrs and these are added to by the wholesaler, the retailer, and finally the consumer. Excessive burrs formerly caused interference between threaded parts to be mated, but the allowance in the new standard eliminates the interference.

4. Much of the freezing of threads under conditions of elevated temperatures will be avoided.

Fig. 5 goes into greater detail as to the general contour of the new thread and shows tolerances, allowance, and crest clearances for classes 1A, 1B, 2A, and 2B.

No attempt is being made here to delve into the intricacies of screw thread theory. The scientific and engineering aspects have been in good hands and the new standard tables speak for themselves in this respect. Several articles have been published on these phases of the problem (1-5).

The most widely used thread class for bolts, nuts, and screws in the old standard is designated as class 2. Its related classes in the new standard are 2A for

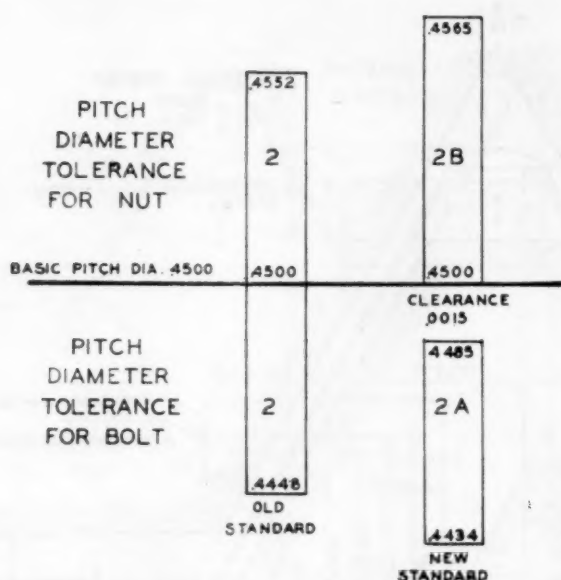


FIG. 6. Comparison of present standard class 2 pitch diameter tolerances with the new standard class 2A and 2B for $\frac{1}{2}$ -13 national coarse thread.

external threads, such as on bolts and screws, and class 2B for internal threads, such as on nuts. Fig. 6 gives a clear graphical example of the difference between the old and the new standards. This difference is shown for one size only, that is $\frac{1}{2}$ inch, 13 threads per inch.

Tables have been compiled for the new standards, covering every conceivable screw dimension for every size and class of fit, and every thread pitch series. For example, the limiting dimensions for the $\frac{1}{4}$ -inch-diameter, 20-threads-per-inch, coarse Unified and American Thread Series, class 2A, for external threads, are:

Size	$\frac{1}{4}$ inch
Threads per inch	20
Thread symbol	UNC2A
Allowance	0.0011
Major diameter limits—maximum	0.2489
Major diameter limits—minimum A	0.2408 for finished and semifinished items
Major diameter limits—minimum B	0.2367 for unfinished items
Major diameter tolerance A	0.0081 for finished and semifinished items
Major diameter tolerance B	0.0122 for unfinished items
Pitch diameter limits—maximum	0.2164
Pitch diameter limits—minimum	0.2127
Pitch diameter tolerance	0.0037
Minor diameter maximum	0.1876

These few figures serve as an indication of the great amount of engineering, mathematical, and editorial

work that went into the tables. It is little wonder that it took so many years to accomplish the task.

The impact of a change such as this one could very well upset the economy of the producer, distributor, and consumer of threaded articles. These three groups represent possibly 90 percent of the world's trade and commerce in manufactured durable articles. An approach to such a world-wide problem calls for extreme caution. The three principally affected groups are now faced with the problem of placing the new standards in effect. However, the job cannot be done fully in a month or a year. It has been estimated that it may take five years from the time of publication of the new tables to complete the conversion.

The producer of threaded fasteners and articles must produce and purchase the necessary new tools,

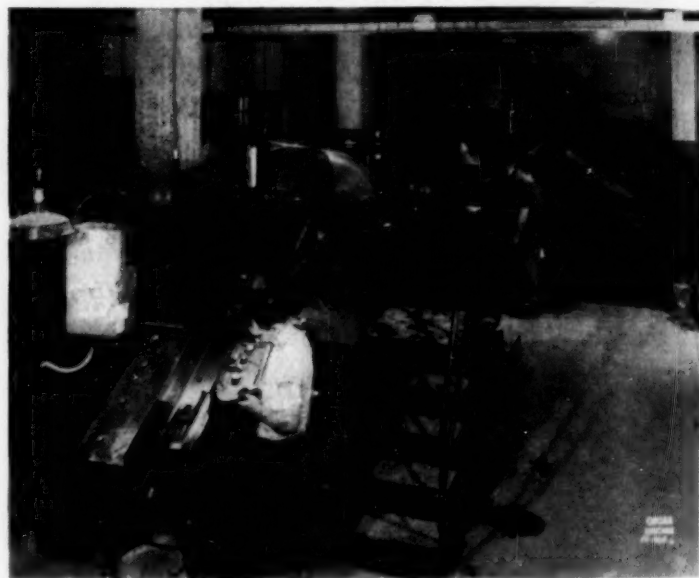


FIG. 7. Modern screw thread rolling machine.

dies, and gauges. If his operations are broad, he may be manufacturing in accordance with both the old and the new standards at the same time, but during the transition period he will gradually increase production of new standard parts and decrease production of the old. He will have products made with both standards in his inventory at the same time. It is fortunate indeed that the old standard threaded fasteners are interchangeable with the related new standard counterpart. If this were not true there would indeed be chaos. A photograph of a modern thread rolling machine, upon which will fall the burden of producing the new standard threads on bolts and screws, is shown in Fig. 7.

The distributor's problem is somewhat simpler, in that he will only need to cope with his inventory, which will contain some of the old standard parts and some of the new during the transition period. Here again, the problem is minimized because of the interchangeability of the old and the new.

The consumer is the man who buys threaded fasteners or threaded articles to be assembled in his plant into manufactured durable goods—automobiles, radios, washing machines, and any number of other articles. He too has a problem during the transition period. His inspection will need to cover either the old or new standard. His warehousing, manufacturing, and assembly operations will need to be flexible to accommodate both standards. He will find it expedient to accept purchased articles, during the transition period, which may have been produced in accordance with either the old or the new standard. His inspectors will no doubt be instructed to accept either standard during the transition period, regardless of which specific standard may have been ordered. It would be simple, from the consumer's standpoint, if on a certain day he could discontinue using the old and start using only new standard threaded articles, but this is obviously impractical. What might have been a complex transition, however, is made easier by the interchangeability of the old and new standard articles.

The entire problem resolves itself into the elements of time, patience, and money. The time, as noted, may be as much as five years, and the patience of both producers and consumers will be tested during this transition. The money is a real consideration—many thousands of dollars will have to be spent on new standard tools, dies, and gauges, on product identification, and on storage systems.

The new standards offer so many advantages to everyone concerned that they will be placed in effect as quickly as possible by all producers and users of threaded articles. Requests for new standard threaded fasteners are already being received from some of the leading national industries. The wheels of industry have been set in motion to accomplish this gigantic task and it may be completed much sooner than we expect.

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Solar Eruption of May 10, 1949

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National Bureau of Standards

AN OUTSTANDING SOLAR FLARE and its effects on the ionosphere were observed in unusual detail on May 10, 1949, at the Sterling Field Station of the National Bureau of Standards. In addition to the usual magnetic variation and continuous wave radio field intensity observations that are always in progress, data were also obtained with solar noise radiometers (Wurzberg) at 480 and 160 megacycles, and rapid sequence, vertical incidence multifrequency (h'-f) observations of the ionosphere. Preliminary determinations of the times of significant activity have been communicated by Helen Dodson, of the McMath-Hulbert Observatory, who estimates the flare as of importance 3+, the greatest reportable on the scale of the International Astronomical Union.

All observations of the eruption and its absorption effects show that it began between 20:00 and 20:03 Universal Time (see Table 1). The solar burst of radio noise seems to have been detected before any terrestrial effect. Estimated errors in time determination are ± 0.25 minute for solar noise observations,

and ± 1 minute for ionospheric measurements. The precision of the McMath estimates is not known. The maximum effect was reached for all types of observation of the phenomenon at between 20:10.5 and 20:12.5; again the solar burst attained maximum first. The duration of the extremely intense portion of the solar noise burst lasted only two or three minutes. The severe ionospheric absorption effects lasted considerably longer, the duration being greatest for oblique incidence paths.

The intensity of the noise burst, presumably emanating from the small visibly active area, was about 290 times the normal energy output of the entire disk of the quiet sun on 160 megacycles, while the intensification on 480 megacycles was probably 1000 times the background radiation. The mirror and antenna of the 480-megacycle radiometer were not set directly on the sun at the time of maximum of the burst, so that the value given is an estimate; the possible range of intensification ratio appears to be between 800 and 1550. This is the strongest burst observed thus far

with these radiometers. Minor bursts previously observed with these instruments have yielded the larger ratio at 160 megacycles.

gining of the brief disturbance, or "crochet," which appears in the magnetic recordings, is aligned with the other phenomena; no maximum can be defined.

TABLE 1
SUMMARY OF SOLAR-TERRESTRIAL PHENOMENA OF MAY 10, 1949

Phenomenon	Time of beginning U.T.	Time of maximum U.T.	First stage of recovery U.T.	Return to normal U.T.	Remarks
H _a flare	20h02m	20h11m	20h30m	After 22h20m	Importance 3+ (preliminary estimates)
Solar noise outburst 160 megacycles	20 00	20 10.6	20 11	20 37	Increase of solar radiation at maximum of 290 times
Outburst 480 megacycles	20 01	20 10.6	20 12	20 53	Intensification at maximum order of 1000
S.I.D. h'-f trace	20 03	20 11	20 30	After 21 11	Absorption of vertical incidence signals up to 6.5 megacycles
S.I.D. (Signal from GLH, England)	20 03	20 12	20 28	21 10	Decrease of 42 decibels
S.I.D. (Signal from W8XAL, Ohio)	20 02	20 11	21 23	22 00	Decrease of 45 decibels
Magnetic crochet	20 03		20 30	20 45	Increase of 24 gammas in horizontal intensity

The strongest outburst of energy occurred during the same period on the two frequencies. The phenomenon started abruptly on 480 megacycles (Fig. 1), with a 39-fold intensification in less than a minute. Thereafter the radiation increased in steps to the maximum. The initial postmaximum decrease was very abrupt. By contrast, on 160 megacycles the phenomenon began gradually, and then there was a 37-fold increase in about two minutes. Again decrease was rapid. The field intensity records indicate a small increase in absorption at the start of the flare, followed within three or four minutes by the abrupt increase (sudden ionospheric disturbance). The be-

A secondary maximum of the 480-megacycle record at 20:18 coincides with a brief increase in the mini-

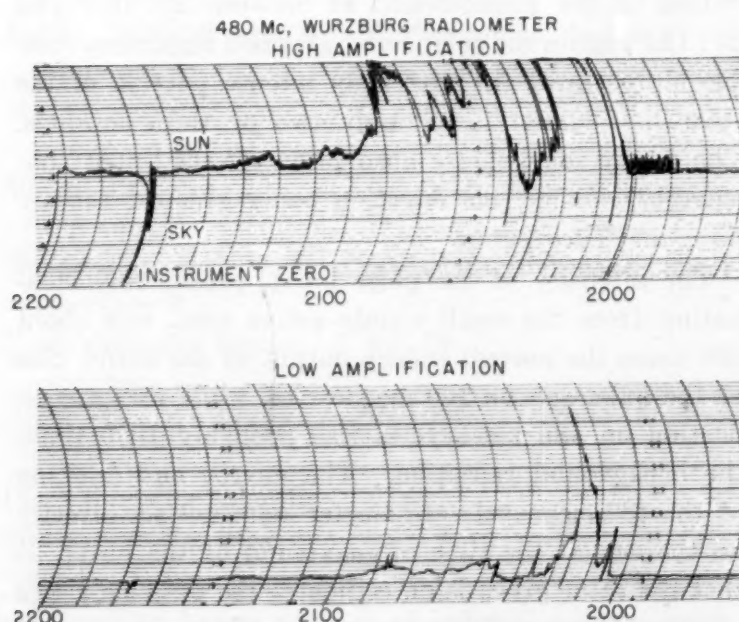


FIG. 1. Solar noise burst at 480 megacycles, May 10, 1949.

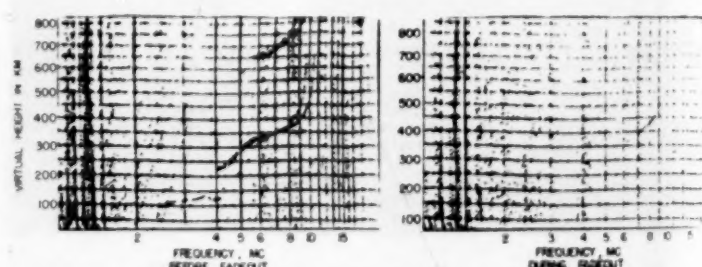


FIG. 2. Multifrequency ionospheric record at beginning of solar flare (left) and at stage of maximum absorption (right).

gining of the brief disturbance, or "crochet," which appears in the magnetic recordings, is aligned with the other phenomena; no maximum can be defined.

num frequency returned at vertical incidence (Fig. 2). Otherwise none of the features of the postmaximum solar records corresponds with details of the recovery stage of the fadeout. The flare had subsided, but had not disappeared, by 22:20 on spectroheliograms taken in the light of the alpha line of hydrogen. The 480-megacycle solar noise became relatively quiet much earlier (by 20:53), while on 160 megacycles, solar radiation was relatively steady after 20:37, though at an enhanced level and with minor fluctuations. Ionospheric absorption effects continued to be noticed as late as 23:00 at the very lowest transmitting frequency; for higher frequencies the effect of the disturbance had disappeared soon after 21:00.

The flare was observed in a rather small sunspot region, with area only 450 millionths of the sun's visible hemisphere. Assuming that the radiation originated entirely in this region implies that the intensity

of the source was 2×10^6 times as great as the average energy from the entire disk at 480 megacycles. This region crossed the central solar meridian on May 11.5 in latitude 18° S. An intense magnetic storm began at 06:24 May 12, 34 hours 22 minutes after the flare, during an interval when disturbance had been forecast by the Central Radio Propagation Laboratory.

This occurrence supports previous evidence that great flares and severe fadeouts start very nearly

simultaneously. The observation that the times of maximum intensity of the bursts of solar noise at 480 and 160 megacycles coincide to within a few seconds differs from the condition observed with the lesser bursts. That this time of maximum intensity is also very nearly the time of maximum absorption is further evidence that the radiation which ionizes the absorbing layer varies in intensity similarly to radiation in the H_α and the 480- and 160-megacycle regions.

TECHNICAL PAPERS

Low Temperature Studies with Colloidal Silicic Acid

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A number of observations have been made in this laboratory during the past two years pertaining to the thermal behavior of silica sols which appear to be related to the properties of ice. The following gives a brief summary of the findings. More detailed reports will be published elsewhere.

The effect of freezing on the stability of colloidal silicic acid is known to be related to pH (4). An extension of the study to liquid air temperatures has revealed that the rate of thawing may have a profound effect with systems frozen at temperatures below about -55°C (e.g. at -65° or in liquid air). When thawed rapidly by immersing the containing vessels (test tubes) in water at room temperature the colloidal system remains stable. However, when the same system is thawed slowly in air at room temperature it coagulates.

An explanation of this phenomenon may be that the ice lattice is more disordered when formed by rapid freezing below about -55°C than it is when formed above this temperature. Freezing the colloidal system in liquid air produces a solid system which approaches an amorphous condition (2). At temperatures higher than about -55°C the ice lattice is more orderly and this causes the colloidal particles to be coagulated when they are crowded together into pockets.

When the system described above is frozen by immersion in liquid air and thawed slowly, the solid state is retained long enough above -55°C for well-defined crystals to form. This results in the dehydration of the colloidal particles in the pockets which serve as loci for coagulation. Under conditions of rapid thawing the more stable lattice does not have a favorable opportunity

to form, hence freezing and thawing do not produce coagulation under these conditions.

It has been demonstrated in a striking way that this fundamental change can occur in the solid state. A sol frozen in liquid air may be held for an undetermined length of time at temperatures below about -55°C (e.g. at -65° or in liquid air), and it will not coagulate if it is thawed rapidly. However, when the sol is frozen in liquid air and then transferred to a temperature above -55°C , but substantially below the melting point, e.g. -35°C , and held at this temperature for 15 min it coagulates irrespective of the rate of thawing. Fifteen min is a relatively short time and it is apparent that the disoriented lattice is metastable with respect to the crystalline lattice.

These observations tend to clarify the reported behavior of a variety of different systems and to strengthen the view that the properties of ice at different temperatures may be a determining factor in the stability of a colloidal system. Thus, it has been reported that hemoglobin and vanadium pentoxide sols coagulate when frozen at -5° , -15° , and -21°C but not at -190°C (1). The rate of thawing of synthetic rubber dispersions frozen at -60°C has been found to have a similar marked effect on the amount of coagulation (5).

It is tempting to correlate the behavior described with the fact that the dielectric constant of ice diminishes abruptly at about -55°C (3). On the basis of free rotation of the water molecule, it can be said that at about -55°C a polymorphic transition from a fine ice structure with a disoriented lattice (not a glassy state) to a more orderly lattice with a higher lattice energy occurs. It is the condition of the ice above -55°C which is responsible for the precipitation phenomena. The lattice energy under these conditions is sufficient to overcome the solvation energy.

Additional information concerning this complex behavior has been obtained by observing the freezing precipitation in the presence of alkali metal halides. Some success has been had in correlating the effect of these

ions on orientation of the water molecule by hydration with their influence on the amount of coagulation during freezing. As predicted, coagulation varies with salt concentration and goes through a minimum at low concentrations. Under favorable conditions coagulation can be entirely inhibited. These effects would appear to have various biological applications.

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Antithiamine Effect of Oxythiamine and Neopyrithiamine. A Comparative Study¹

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According to Wilson and Harris (3), pyrithiamine does not have the structure assigned to it. These workers have synthesized a new compound which they call "neopyrithiamine," and which shows chemical and physical properties that would be expected from the pyridine analogue of thiamine. When this compound became available,² an experiment was set up with a view of comparing its antithiamine effect with that of oxythiamine, which was shown in this laboratory to act as an antagonist for thiamine (2).

Mice of the Swiss and C-57 Black strains from our stock colony were used. The animals were placed at weaning on a thiamine-deficient diet which consisted of casein (Labco) 25%, sucrose 53%, hydrogenated vegetable oil 10%, lard 5%, Osborne and Mendel salt mixture³ 5%, and Ruffex 2%, and contained the following supplements per kg of diet: riboflavin 10 mg, pyridoxin 10 mg, calcium pantothenate 100 mg, α -tocopherol 40 mg, β -carotene⁴ 20 mg, vitamin D (Drisdol) 5000 units, and choline chloride 1.5 g. When the animals had become steady in weight, they were maintained on 1 μ g of thiamine per day, injected in aqueous solution subcutaneously for one week. Daily injections of oxythiamine or neopyrithiamine were then started together with 1 μ g of thiamine in a ratio (thiamine:antivitamin) of 1:50. Control animals, three for each group, received thiamine alone. The results are shown in Table 1.

In the case of both compounds the effect on the food intake was apparent overnight. There was a drop in

the food intake of the animals and a loss in weight. The data show that the antivitamin effect of neopyrithiamine is more pronounced than that of oxythiamine.

TABLE 1
COMPARATIVE ANTITHIAMINE EFFECT OF OXYTHIAMINE AND NEOPYRITHIAMINE

Substance tested	No. of mice	Wt of mice at start of injections of anti-vitamin g	Incidence of polynueritis %	No. of days before polynueritis developed	Survival time in days
Oxythiamine	9	10.6-13.6	0	...	13-21
Neopyrithiamine	9	10.2-13.8	100	5-7	7-8

This manifested itself in the development of polynueritic symptoms in the animals treated with neopyrithiamine and in a shorter survival period. The polynueritic syndrome was similar to that described by Morris (1). In addition, we observed that the mice were apt to hold their heads on one side, and that they developed complete paralysis of the hind legs. The controls maintained their weight, and they survived until they were sacrificed two weeks after the last animal in the corresponding experimental group had died.

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Mechanical Transmission of a Plant Tumor Virus to an Insect Vector¹

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Most plant viruses transmitted by leafhoppers have not been demonstrated to be infective in extracts. The virus dealt with in this paper causes tumors in certain susceptible plants, is carried by leafhoppers, and like others in that group has proven difficult to detect in extracts. It is our purpose to recount briefly the variety of methods that failed to transmit the virus and to report on the success of insect-to-insect transmission by injection.

The virus, known as wound-tumor virus, *Aureogenus magnivena* Black (2), is transmitted from plant to plant by the leafhoppers *Agalliopsis novella* (Say), *Agallia constricta* Van Duzee, and *Agallia quadripunctata* (Provancher). Attempts by the authors to transmit the virus

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² We are indebted to Dr. K. Folkers of Merck & Co., Inc. for the neopyrithiamine.

³ The quantity of manganese was doubled.

⁴ A mixture of 90% beta and 10% alpha carotene (GBI) was used.

mechanically from plant to plant have been made, using various methods of inoculation, both with untreated juice from infected plants and also after the addition of materials to the juice to alter the osmotic pressure, pH, and oxidation-reduction potential with the aim of stabilizing the virus. Juice has been rubbed onto the leaves and injected into the stems and crowns of plants by different techniques. Several species of susceptible plants have been used in these experiments, but an infection has never been obtained by any of these methods. The inoculation of plants with juices from infective insects also failed to produce infection, even though such juice was proved to have infective virus when tested by the successful technique described here. Leafhoppers fed on juices from diseased plants, from viruliferous insects, and on concentrates of these juices prepared by high speed centrifugation did not become infective. It is possible, of course, that more extensive trials with these procedures or variations of them might yield positive results.

Storey (5) was the first to transmit a plant virus from insect to insect by inoculating virus-free vector leafhoppers, *Cicadulina mbila* Naude, with juice from insects carrying maize-streak virus, *Fractilinea maidis* (Holmes) McKinney (3). Using fine glass capillaries, Black (1) transmitted the aster-yellows virus (*Chlorogenus callistephi* H. var. *vulgaris* H.) by injecting juice from viruliferous into nonviruliferous leafhoppers (*Mucrosteleus divinus* Uhler). In view of these earlier successes, it seemed logical to attempt transmission of the virus by injecting healthy vector leafhoppers with extracts from insects carrying wound-tumor virus.

Three hundred and fifty nonviruliferous leafhoppers (*Agallia constricta* Van Duzee) were caged on crimson clover plants (*Trifolium incarnatum* L.) showing pronounced symptoms of wound-tumor disease and were kept there for four weeks at about 25° C. Maramorosch had previously (4) obtained good transmission of the virus at 25° C with this vector, after a minimum incubation period in the insect of two weeks. The insects were then collected and ground at 0° C with an equal weight of 0.25 M NaCl. The suspension was centrifuged at 3500 rpm for 5 min, and the supernatant used without further dilution for the injection of 28 virus-free nymphs. The solution was drawn up into a fine glass capillary, and a small amount forced into the insect through a puncture made in the abdomen with a glass capillary. Twelve of the 16 insects which survived the injection proved to be infective when tested on crimson clover plants. Although no controls were included in this experiment, the results are considered significant because there were no accidental infections with this virus in the greenhouse during the course of this experiment or the two previous years.

A second experiment was carried out to confirm these results as well as to obtain a first approximation of the dilution end point. An extract of viruliferous insects was prepared as in the first experiment, and 0, 10⁻¹, 10⁻², 10⁻³, and 10⁻⁴ dilutions were made with 0.25 M NaCl. Groups of 20-30 insects were inoculated with each dilution, and an equal number of uninoculated insects were

kept as controls. All insects were tested individually on two sets of crimson clover plants over a period of two months, and the plants were then observed in the greenhouse for an additional period of two months. None of the control insects became infective, but some insects inoculated with each dilution of viruliferous insect extract up to and including 10⁻³ did. There was a long incubation period before inoculated insects were able to infect healthy plants with wound-tumor virus.

These experiments show that wound-tumor virus can be detected in extracts from insects, and the experiments also make possible the determination of some of the physical and chemical properties of the virus. The fact that three leafhopper-transmitted plant viruses have proved transmissible by this method of insect inoculation suggests that the method may succeed in certain instances where other techniques have failed.

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The Chromatographic Estimation of Lysine and Some Applications of the Method¹

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In exploring the various published chromatographic techniques, it occurred to us that paper chromatography of the copper salts of amino acids might provide a simple means of estimating some of the amino acids. The salts were prepared as described in our modification of the Pope and Stevens procedure for determination of the amino acid N (1) and 0.02-cc aliquots of the resulting solution partitioned on paper strips in an aqueous phenol atmosphere for 6 hr by the capillary ascent principle described by Williams and Kirby (2). After drying in air the strips were developed by painting with a freshly prepared 10% solution of aqueous iron ferrocyanide. The characteristic pink color of copper ferrocyanide, which appears distinctly on drying, indicates the position and relative amounts of various amino acids on the strip. Tests with 60 γ of purified specimens showed glutamic and aspartic acid to have overlapping R_f values in the area 0.08-0.10. Lysine occurred in the region 0.42-0.50. Arginine and histidine overlapped in the 0.55-0.62 R_f zone. The other amino acids, glycine, serine, threonine, valine, leucine, isoleucine, tyrosine, proline, hydroxypro-

¹ Supported in part by funds from the Office of Naval Research.

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line were to be found in the zone 0.7–1.0. Tryptophane, methionine, cystine, and phenylalanine could not be identified by this technique, since they are oxidized during the partitioning process.

For our purposes the lysine band, because of its relative consistency, proved most useful. The band spread of the copper lysine salt is roughly proportional to the concentration in the range 30–60 γ of lysine. With protein hydrolyzates containing initially 0.5 mg N/cc it was found that zein gave negative tests; wheat gluten gave faintly positive tests; and casein, gelatin, lactalbumin, human hemoglobin, and fibrin gave bands which approximated roughly the lysine content of the preparations.

Fivefold-concentrates of urines of adult or infants on normal diets showed the lysine concentration to be greater for the infant than for the adult. When a wheat gluten diet supplemented to contain 4% L-lysine was fed to infants, the lysine output was similar to that of an evaporated milk diet. When the infants were fed wheat gluten diet without the lysine supplement, the urine lysine level fell below the sensitivity of the test. Supplementation of this diet with 6% D-lysine caused a tremendous increase in the lysine output, which became normal on changing to 6% L-lysine. On the basis of this observation and the poor N-retention and weight changes manifested by infants maintained on the D-lysine-supplemented wheat gluten diet it would appear that D-lysine is not utilized for growth by the infant.

Blood filtrates could not be manipulated satisfactorily to give positive tests by this procedure.

Within limitations this method is a useful one, but it cannot be expected to yield better than semiquantitative results. Other metal salts of the amino acids—namely, nickel, silver, chromium, mercury, lead, and barium—are being studied to determine their chromatographic characteristics.

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Quantitative Study of Root Systems in Different Soil Types

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Study of soil-root relations of various crop plants and range grasses has lagged far behind the pressing need for an understanding of these relationships. Little progress in devising new methods for such study, at least methods that have been widely used in the field, has been made since the extensive researches by the direct method, using trench and hand pick, employed by Weaver (1, 2) during the period 1919 to 1926. This lack of a quantitative approach to comparative root studies in various soil types has undoubtedly been a chief reason for the dearth of more definite information on this important subject.

A new method has recently been devised by which a complete sample of an entire root system from soil sur-

face to maximum depth of penetration may be taken, separated from the soil without injury to the root or displacement of individual roots from their natural position, and examined in the laboratory in relation to the various horizons of the soil profile. The method, applied to range grasses, consists in obtaining monoliths of soil 12 in. wide and 3 in. thick to a depth, varying with root extent, of 3–6 ft.

A trench about 3 ft wide and 4–5 ft long is dug in a site where there is normal development of vegetation. The depth is usually 4–6 ft. Beneath the particular sample of grass, previously selected and left undisturbed in the side wall, the wall of the trench is made smooth and vertical, as shown by a plumb line. A long shallow wooden box, 12 in. wide and 3 in. deep (inside dimensions), without a top and lacking one end, is employed. It is placed on end, with the closed end downward. The open top is placed against the vertical trench wall, the upper end of the box just reaching the soil surface. An impression of the sides and lower end of the box is made on the vertical wall of the trench by tapping the bottom of the box vigorously with a 4-lb sledge. The box is then removed and the soil column marked out with butchers' knives having rigid blades. The soil on the sides and below these marks is removed by means of knives and spades until the monolith protrudes from the trench wall, its sides and bottom extending outward at least 3 in. The box is then fitted tightly over the monolith and the bottom and lower end of the box are braced to hold the soil column in place. Finally, the soil on the inner, attached face of the monolith is cut away by working inward with knives and spades from each side. The soil is not cut close to the top of the box, but a V-shaped ridge of soil is left protruding throughout its length. This is a part of the sample when the braces are removed and the monolith is lifted out of the trench. The entire monolith is transported to the laboratory, where a description of the profile as regards soil texture, structure, consistence, pH, etc. is made. Only then is the monolith reduced to exactly 3 in. in thickness.

The soil is removed from the box by a process of repeated soaking, often for several days, and gentle washing, mostly under water, even when it is extremely compact or contains a claypan. A flaring rose nozzle attached to a garden hose is employed. During this process one may study the intimate relations of soil and roots. Roots are unharmed and in their natural position in the water after the soil has been washed away.

The root system is transferred to a large smooth painted board. The board is kept wet and tilted while the roots are finally washed free of any remaining soil. Excess water is then removed by large blotters and the damp root system is transferred to a mounting board covered with cloth of black felt. This is done by placing the mounting board, face downward, over the root system, holding the two boards tightly together, and inverting them. The painted board is then removed. The root system is lighted for photographing by electroflash units. It may then be dried and preserved indefinitely or cut into sections according to depth in feet or according to

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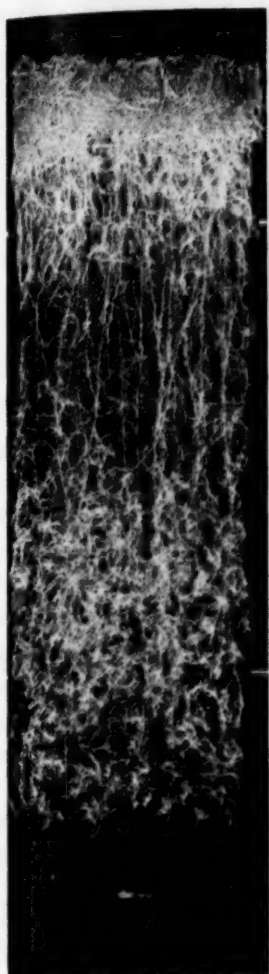


FIG. 1. Portion of a root system of western wheat grass (*Agropyron smithii* Rydb.) 12 in. wide and 36 in. deep. The bottoms of the A and B horizons are marked by white lines. Only a small portion of the roots in the C horizon is shown.

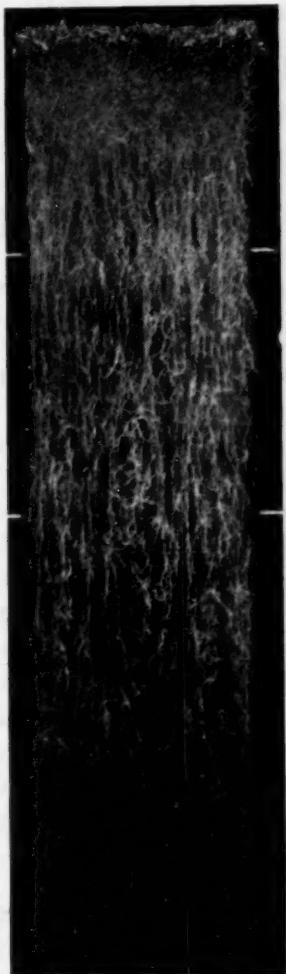


FIG. 2. Upper 4 ft of roots of buffalo grass *Buchloë dactyloides* (Nutt.) Engelm. Upper lines mark the depth of a 12-in. fill which gradually buried the former topsoil (A_{1-1} horizon). 14 in. thick. Note excellent root development in these layers.

depth of the soil horizons it occupied. The roots are then oven-dried and weighed.

The root system in Fig. 1 was taken from Butler silt loam soil 28 in. deep, overlying deep, friable, silty clay loam parent material. The A horizon, which is only 7.5 in. thick, contained 67% of the roots by weight. Roots were poorly branched in all but the lower part of the claypan or B horizon. Most of the branching occurred in the C horizon of less compacted, friable silty clay loam. Roots in the 13 in. below the point of heavy branching weighed 36% more than the 13 in. of poorly branched roots above. The root system in Fig. 2 was taken from Wabash silt loam in a valley between two loess hills. Although the grass is normally only 4-5-in. tall, the roots are 5-6 ft deep.

Descriptions have been made of the profiles of 16 soil types, from which 11 species of grasses were taken in a total of 33 monoliths in 1948.¹ The depth, density, and weight-distribution of roots of the same species in dif-

ferent soil types and of different species in the same soil type have been ascertained. Quantitative data on root distribution in the several soil horizons have also been obtained. The effect of buried profiles on root habit has been examined, as have modifications resulting from the loss of one or more soil horizons by erosion. A detailed account of the work is in press.

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A Simple Micromanipulator

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For the isolation of one microscopic cell a fine capillary pipette is often used, the point of which is inserted into the drop of fluid containing the organisms; under microscopic control a single cell can then be sucked into the capillary pipette. The difficulty of this operation consists in keeping the point of the pipette motionless, at a magnification of, say, 100 times, in front of the organism, which in many cases has a size of only 10-25 μ .

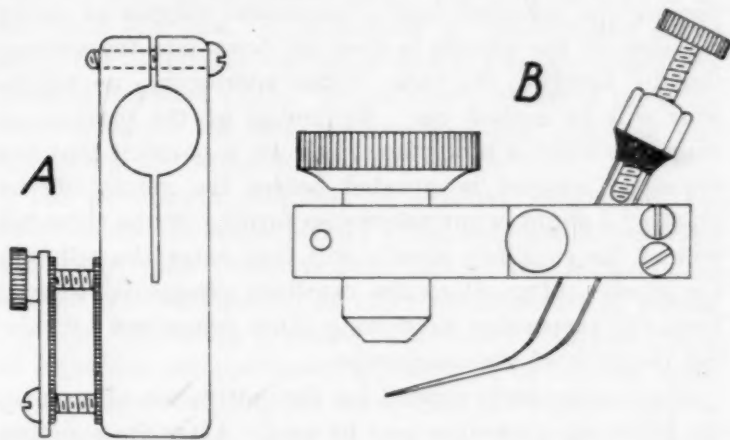


FIG. 1. A. Micromanipulator top view without the capillary pipette. B. Micromanipulator with the capillary pipette, side view, mounted on the objective of the microscope. Three-fourths natural size.

The device described here is one whereby the pipette can be fastened to the objective of the microscope. By means of the mechanical stage of the microscope, the organism can then be moved to the mouth of the fastened capillary pipette and sucked up.

As shown in Fig. 1, the apparatus may consist of a block of metal 55 mm long, 15 mm broad, and 10 mm high, or to avoid scratches on the side walls of the objective, of a corresponding piece of ebonite or plastic used for insulating purposes by the electrical industry. In one end, there is a vertical hole for the objective, and a deep incision so that the walls of the hole can be fastened around the objective by means of a threaded bolt. On the side wall of the other end is placed a retaining plate, so that the capillary pipette can be pressed against one vertical wall of the block by means of three screws. Small pieces of felt or thin plates of

¹ Profile descriptions were made by Mr. James Thorp, Principal Soil Correlator, Great Plains States Division of Soil Survey, U. S. Dept. of Agriculture.

cork glued to the walls of the block and the retaining plate prevent breaking of the pipette.

The capillary pipette is a 5-mm glass tube, one end of which has been drawn into a long, thin point and bent to form an angle of about 135° with the tube. At the other end of the tube, a small but high nut with a threaded bolt to match is fastened by means of glass cement. It is very important that the bolt should fit exactly into the thread of the nut and that it is greased with a heavy lubricant of the kind used for glass stopcocks of burettes, in order to make a completely air-tight connection. It is desirable to have a set of capillary pipettes, the points of which are 25, 50, 100, and 500 μ thick respectively.

When the apparatus is to be used, the block is fastened to the objective, after which the capillary pipette chosen is placed in such a position that the mouth of the pipette is clearly visible in the center of the field of vision (magnification about 100 times) and the point is nearly horizontal.

If a single microscopic organism is to be selected from a fluid suspension of organisms, it cannot be done by lowering the empty capillary pipette into the drop on the slide. The capillary action, which increases with the diminishing diameter of the pipette, will immediately carry fluid with numerous organisms into the tube. The pipette must be allowed to suck up sterile water and by turning the threaded bolt a convenient column of water remains; if the pipette is then let down into the suspension by lowering the tube of the microscope, no organisms will be sucked up. By means of the mechanical stage the slide is now placed in such a position that the organism selected is situated before the mouth of the pipette; a slight counterclockwise turning of the threaded bolt of the capillary pipette will then carry the cell into the pipette, after which the capillary pipette is removed from the suspension containing other organisms by raising the tube of the microscope.

If an organism is wanted for the cultivation of a clone, the following procedure may be used. After the selection of one cell, the slide with the suspension is replaced with a sterile slide, on which a sterile cover glass is placed. The tube of the microscope is lowered until the point of the capillary pipette touches the cover glass; a slight clockwise turning of the threaded bolt will now eject a droplet of water containing the chosen cell onto the cover glass. At a magnification of, say, 200 times it should now be ascertained that the droplet contains one and only one cell. If this is the case, the cover glass can be slipped from the slide into the sterile fluid in which the species is to be cultivated.

The apparatus can also be used for making permanent slides of new or rare species, where only a few individuals were found among many others, for instance, desmid individuals in a plankton sample. Some drops of glycerine should be added to the sample, which is then placed on a watch glass or in a salt cellar to allow a slow evaporation of the water. The specimens wanted can now be selected from the glycerine suspension and placed in a droplet of pure glycerine on a slide for the usual method of preparing the slide.

Pterin-like Pigment Derived from the Tubercle Bacillus. Fluorescence and Absorption Spectral Data for Erythropterin-like Pigment Isolated by Ultrachromatographic Analysis

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The pterins are pigments having a purine or pyrimidine type of structure that were isolated from the wings of butterflies and from the integument of other insects, first by Hopkins (5) and later by H. Wieland and his collaborators (1925-1944), and by Schöpf and Becker (11), and others. These pigments usually occur as mixtures, have no melting points, and cannot be transformed into derivatives with definite melting points. Hence, they present exceptional difficulties in their separation and purification. The determination of absorption spectra was one of the criteria used, in the studies cited, as tests in successive stages of purification, and in order to characterize the different pterins derived from different sources (11).

We present evidence in this report that pterin-like pigments have been isolated from the tubercle bacillus which, to our knowledge, have not heretofore been reported for this microorganism. Fluorescence and absorption spectral data and other physical characteristics are given for material obtained from the acetone and ether extracts of dried virulent human tubercle bacilli¹ after they had been washed with large quantities of sterile distilled water. This treatment is one of the steps in the preparation of antigens used in the complement-fixation test for tuberculosis (14b).

Observations in ultraviolet light were made of zones (some not visible in daylight) formed when a few drops of the extracts were placed on the margin of the thin wedge of an adsorbent such as aluminum oxide, standardized according to Brockmann (1) by Merck, hereafter called alumina. These zones yielded fluorescence other than the red fluorescence that may be attributed partly to porphyrin and the yellow fluorescence of flavin reported in our previous studies (4). This micromethod (2) indicated the practicability of separating some of the materials on chromatographs of alumina.

Numerous exploratory experiments indicated that a better separation of zones was effected by the use of benzine ether 1:1 and chloroform solutions of the residues of ether and acetone extracts than with the original extracts. In some of the experiments the extracts were partitioned with immiscible solvents prior to placing them on chromatographs. The yield of material from the different zones was in each case very small. Hence, it was not possible to make all of the various characterizations

¹ Human tubercle bacilli strains #13 and #48189 were grown for 3-4 weeks in glycerol broth which consists of beef, 450 g; peptone (Fairchild's), 10 g; sodium chloride, 5 g; glycerol, 50 g; and water, 1000 g (14a).

that were reported by Schöpf and Becker for the much greater quantities of pigment that they extracted from the wings of a million butterflies. Our material has been used chiefly for the determination of absorption and fluorescence spectra. These spectroscopic data and observations of the general chromatographic behavior and patterns of the various zones when the chromatographs are developed closely parallel those reported for pterins from butterflies, as do certain other characteristics.

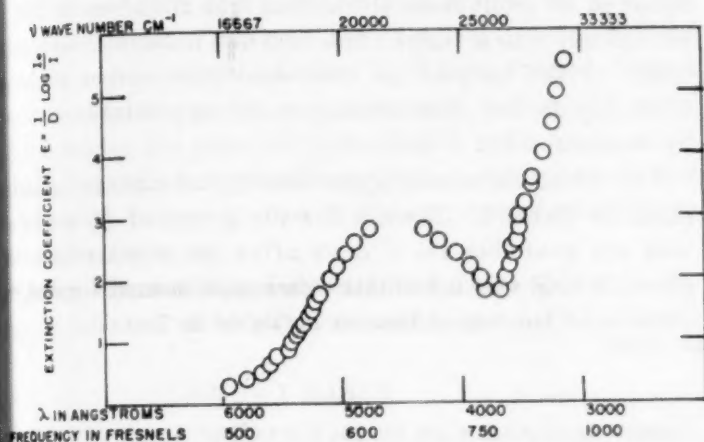


FIG. 1. Ultraviolet absorption spectrum curve. Erythropter-like pigment (in chloroform) isolated from human tubercle bacillus.

The number of fluorescing pigments revealed on our chromatographs and the reported difficulties of separating them preclude an exhaustive study of all at this time. Observations have been focused mainly on the material from the dark velvet brown fluorescing zone (orange-red in daylight and the only one clearly visible), which has many other characteristics similar to those reported for erythropter (11).

The ultraviolet absorption spectrum curve for this pigment in a limited range (Fig. 1) shows a band at about

band extending from λ 3580 to 4635 Å with a maximum at λ 3992 Å.

The chromatographic behavior on a column of alumina has been reported (11) for a mixture of several pterins—erythropter, chrysopter, xanthopter, etc. The erythropter is adsorbed at the top of the column as a velvet brown fluorescing zone, chrysopter as a yellow-green fluorescing zone just below the erythropter and above the yellow fluorescing xanthopter zone. Moreover, a brilliant light violet-blue fluorescing zone usually appears in juxtaposition with the velvet brown fluorescing zone and is ascribed by Schöpf and Becker to a transformation product of erythropter. We also have observed this sequence of zones on our chromatographs. The medium which is used in the cultivation of the tubercle bacillus, when concentrated ten times and passed through columns of alumina, did not show this zone formation. However, the effect of strain differences and of variations in medium are being investigated.

Erythropter, as reported by Schöpf and Becker (11), is precipitated from N ammoniacal solution by treatment with N HCl as a fine red powder that is easily soluble in water. On evaporation of the solution the residue is amorphous. An ammoniacal solution of the pigment, when treated with an ammoniacal solution of silver nitrate, yields a fine dark red precipitate, which when heated turns brown, then black. Erythropter gives no murexide reaction. It is soluble in concentrated nitric acid; but is quickly destroyed and the dark red solution becomes colorless (11). We also have observed the same characteristics for the erythropter-like pigment isolated from the tubercle bacillus.

The wavelength positions of selective absorption, the fluorescence characterization, chromatographic behavior, and many other reactions observed for our material are similar to those reported by other investigators of pterins (5, 11). Hence the presence is indicated of a new group of pigments not previously reported to be isolated from the tubercle bacillus. A more detailed report will be published later.

We also have reported the isolation of pterin-like pigment from the diphtheria bacillus (3). Members of the pterin group of pigments have been found in animal and human urine (8), mammalian tissue (9), and in argentaffine cells in the epithelium of the stomach and intestine, with the same localization as that of the substance active against pernicious anemia (6, 7). Studies have been made of the activity of pterin in preventing clinical anemia (13), and also in the field of nutrition by Totter and colleagues (12), Pritchard (10), and numerous other workers. Such investigations, if further substantiated and extended, will result in the pterins' becoming of wide interest and importance in the fields of biological and medical research.

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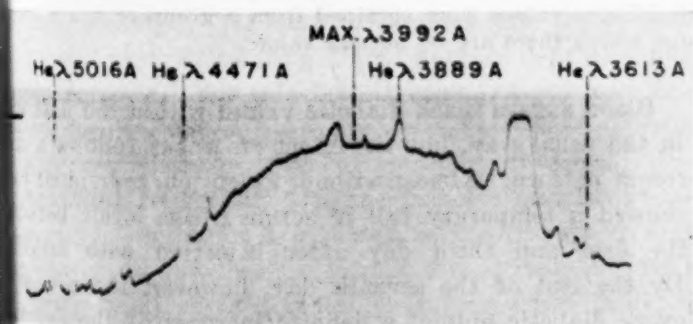


FIG. 2. Microphotometric tracing of a fluorescence spectrogram of erythropter-like pigment (in chloroform) isolated from human tubercle bacillus.

λ 4540 Å. Exploration of the shorter wavelength region revealed a band at about λ 2375 Å and an inflection between λ 2900–3200 Å, indicating selective absorption in the same wavelength positions reported by Schöpf and Becker for an erythropter preparation (11).

A violet fluorescence in dilute ammoniacal solutions of erythropter and changes in the fluorescence with changes in pH values have been observed (11). We also have noted similar fluorescence with the pigment recovered from the orange-red zone. A microphotometric tracing of the fluorescence spectrogram (Fig. 2) shows an emission

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Serum Lipase and Alloxan Diabetes in Rats¹

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It was found by Cantor, Tuba, and Capsey (1), that the production of alloxan diabetes in the adult male albino rat is paralleled by a pronounced increase in the activity of serum alkaline phosphatase. The development of the diabetic condition is usually accompanied by a marked transient lipemia, which appears about two days after the injection of alloxan and which then decreases after approximately a week. It seemed probable that the existence for several days of a severe lipemia might be reflected in altered serum lipolytic activity, and this paper presents our observations with the enzyme which hydrolyzes tributyrin. This enzyme, given a variety of names in the literature, will be called lipase, although it could equally well be called tributyrinase (2).

Twenty adult male rats were starved overnight and in the morning each was given a subcutaneous injection of 16 mg of alloxan monohydrate for each 100 g of body weight. The animals were fed Purina Fox Checkers and water ad lib. As a result of alloxan injection, diabetes was produced in fifteen rats; three of the animals died, while two recovered from the initial hyperglycemia.

Blood for glucose and lipase determinations was taken from the tails of the animals always at 8 A.M. Blood glucose was estimated by the method of Reinecke (3). Lipase activity was determined within 24 hr after the serum was obtained although the enzyme was found to be stable for several days in a refrigerator. The enzyme concentration of the sera was determined by a micro-method which will be described fully elsewhere. Essentially it consists of estimating by titration with NaOH the acid set free from tributyrin by the enzyme contained

in 0.1 ml serum. Hydrolysis of the finely dispersed substrate proceeds for 30 min at 37° C in an aqueous digest buffered with sodium diethylbarbiturate at pH 7.9. The lipase activity of a serum in units is equivalent to the number of ml of 0.025 N NaOH required to neutralize the butyric acid which would be set free by the enzyme contained in 100 ml of serum under the above experimental conditions. One ml of 0.025 N NaOH is equivalent to one lipase unit. The normal mean value for serum lipase in 30 adult male albino rats was found to be 556 ± 70/100 ml, with a range from 390-690 units/100 ml. Activity of the enzyme in individual rats varies slightly from day to day, but levels are not appreciably altered by starvation for 5 days.

The effect on serum lipase activity of alloxan is indicated in Table 1. Results for the group of 15 diabetic rats are available for 7 days after the onset of hyperglycemia and this information is supplemented for longer periods of time as indicated in Table 1.

TABLE 1

EFFECT OF ALLOXAN ON SERUM LIPASE OF ADULT MALE RATS

Time after alloxan injection	Blood sugar (mg/100 ml)		Serum lipase (units/100 ml)	
	mean	range	mean	range
0	117	90-120	556 ± 70*	390-690
1 day	360	315-450	536 ± 102	320-730
3 days	544	230-800	541 ± 80	410-730
5 days	434	260-670	686 ± 105	510-890
7 days	429	314-630	800 ± 67	690-890
21 days†	426	400-450	830 ± 92	760-1000
3 months‡	350	250-400	930 ± 238	930-1400

* The values following the ± sign represent the standard deviation.

† These values were obtained from seven of the group of 15 rats.

‡ These values were obtained from a group of five animals for which there are no normal values.

Blood sugars reach diabetic values within the first day in the usual way, but the effect on lipase follows a different pattern. Almost without exception, individual rats showed a temporary fall in serum lipase levels between the first and third day after injection with alloxan. By the end of the seventh day, however, there was in every diabetic animal a definite increase of the enzyme with an average increase to about 40-45% above normal levels for the group of 15 rats. The results given in Table 1 for rats diabetic for periods of time up to 3 months indicate that the enhancement in lipase activity of rat serum is persistent and may reach concentrations as much as 65% above normal. The development of increased lipase levels roughly parallels the appearance of high alkaline phosphatase values in alloxan diabetic rats.

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¹ This investigation was conducted with the assistance of a grant to Jules Tuba from the Division of Medical Research, National Research Council, Ottawa, and is part of Project M.P. 211.

Growth-regulating Substances in *Laminaria agardhii*

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Growth-regulating substances have been reported from nearly all major groups of the plant kingdom, but in the lower forms little is known of their role in the differentiation of thalli. The presence of a large, differentiated lamina in *Laminaria agardhii* Kjellman, formed from a well-developed intercalary meristematic region, suggested to the author the possibility that IAA (indoleacetic acid) might behave as a growth-regulating substance in this brown alga just as it does in the embryonic apical parts of vascular plants.

Along the southern New England coast this kelp develops laminas which are commonly over 5 ft in length

tamination and evaporation. Disks were blotted between filter paper before each weighing, which was done on an analytical scale accurate within 1 mg. The blotted weights of disks in any one series were rather uniform.

From Table 1 a gradient for tolerance of IAA is shown by the response of cultured tissue. The rate of poisoning and disintegration in IAA solutions varies greatly with each series, being greatest in series A, less in series B, and least in series C. Apparently IAA is supplied by the alga itself and the disks injured come from regions already containing so much IAA that addition of any more produces an injurious excess.

Because of these results a hormone test was performed. The bending of the *Avena* coleoptile for detecting the presence of growth-promoting auxins in vascular plants is a standard procedure, but except for the method used by Leonian (2) with fungi, the author does not know of any procedure for demonstrating the presence of minute quantities of auxin in algae. A crude extract in petro-

TABLE 1
PERCENTAGE GAIN OR LOSS IN WT OF DISKS FROM *Laminaria agardhii* AFTER 16 DAYS' CULTURE
IN INDOLEACETIC ACID SOLUTIONS

IAA in sea water mg/l	Series A Total wt 3554 mg	Series B Total wt 1490 mg	Series C Total wt 920 mg
0 (control)	+ 13% (healthy)	+ 10% (healthy)	+ 5% (healthy)
0.1	disintegrated	+ 16% (healthy)	+ 8% (healthy)
1.0	disintegrated	+ 5% (healthy)	+ 23% (healthy)
2.0	disintegrated	- 20% (fair)	- 10% (fair)
5.0	disintegrated	disintegrated	- 15% (fair)
10.0	disintegrated	disintegrated	- 30% (unhealthy)

and 8 in. broad. Young laminas are thin and homogeneously flattened, but mature laminas are thick, with peripheral parts undulating from alternate depressed and raised portions. For this investigation, plants were collected during June and July of 1948 from several habitats in the vicinity of Woods Hole, Massachusetts.

According to Fritsch (1), the principal formative region in all laminarias is situated in the transition zone between stipe and lamina. From this region 120 disks of living tissue of *Laminaria*, measuring 6 mm in diameter, were used in test series A. Series B consisted of 120 disks from the middle and distal third of laminas; and series C, of 120 disks from the distal third and thin periphery of laminas. An effort was made to get random samples from plants with laminas at a developmental stage just prior to formation of the undulating periphery. The 120 disks of each series were distributed in lots of 20 to liter beakers containing sea water and various concentrations of IAA. A temperature range of 18-21° C was maintained by setting the beakers in running water. Each beaker was covered by a glass plate to reduce con-

leum ether was prepared by soaking dried macerated tissue from the formative region. The ether extract was mixed with lanolin paste and evaporated. Oat seeds were germinated in the dark between moist filter paper and the inside of liter beakers. The crude extract of kelp was applied by a fine glass needle. After 8 hr, but more pronounced after 17 hr, the following results were noted: Seedlings with kelp extract applied on the outside bent toward the center of the beakers; those with extract applied on the inside bent away from the center, and those without extract treatment and those treated with lanolin only continued to grow straight.

The results of this investigation indicate that growth substances, similar to or the same as indoleacetic acid, formed in the meristematic region of *Laminaria agardhii*, may be at least partly responsible for the mature pattern of growth in the lamina, and that the natural growth-regulating substances in this alga have some physiological properties in common with those of higher vascular plants.

References

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¹ The author acknowledges the assistance in this research of Mr. Ko Ko Lay, graduate student at Washington University.

Comments and Communications

Dramamine and Motion Sickness

I should like to comment on the two articles on motion sickness by Gay and Carliner and Strickland and Hahn that appeared in your April 8th issue (*Science*, 1949, 109, 359).

Gay and Carliner's procedure of dividing the subjects into control and medication groups on the basis of the ship's compartments they occupied may be expeditious from an administrative standpoint but is hazardous experimentally. The various compartments of a ship are not subjected to the same degree and kind of motion. It is, therefore, difficult to ascribe the differences in sickness rates found in the several compartments solely to the medication employed. It is quite possible, for instance, that compartment 3-F was more conducive to causing seasickness than compartment 3-E. To have controlled this adequately, the investigators should have randomly divided the men in each compartment into the various experimental groups.

The procedure of using sick men in a placebo group to test the efficacy of a remedy in curing the already sick can be safely done only if a like number of sick men in the same group remain untreated or continue to receive placebos. Drs. Gay and Carliner, by neglecting this, left themselves without adequate controls and therefore one cannot determine with certainty to what extent the remission of symptoms was due to medication (Dramamine), change in weather and sea conditions, or to the phenomenon of adaptation. The latter is of great importance.

Studies of the efficacy of a remedy must be made under a variety of sickness rates and the results should be expressed as the percent protected for a given sickness rate. At placebo rates of between 20 and 30 percent—the rate apparently found in the Gay and Carliner experiment—it is not uncommon for medication such as hyoscine, or even certain barbiturates, to give high protection. With such moderate sickness rates in the controls this writer has, on occasion, found 0.6 mg hyoscine to give 80 to 90 percent protection. Therefore, on the basis of the single experiment reported, no convincing evidence is presented to indicate that Dramamine is any more effective than 0.6 mg hyoscine in preventing motion sickness. This is further borne out by the paper of Strickland and Hahn in which they report an experiment where 55.6 percent of the placebo group became sick. Under this moderately high sickness rate, 28.7 percent of a like number receiving Dramamine became sick, indicating that the medication gave protection to about 50 percent. With such sickness rates in the controls, 0.6 mg hyoscine has been shown to give similar protection (*Amer. J. Physiol.*, 1946, 146, 458). Incidentally, this dosage of hyoscine has been demonstrated to be without any harmful side effects on the efficiency of combat men.

Therefore, until Dramamine, or any other proposed remedy, is tested under adequately controlled conditions, against hyoscine as well as a placebo, and under conditions of a variety of sickness rates in the controls, any claims as to its superiority as a preventive are apt to be premature.

Finally, the statement in the opening paragraph of the paper by Strickland and Hahn, "Investigations on motion sickness in the past have shown a paucity of controlled studies carried out on shipboard or on aircraft," leave many of us who were connected in one way or another with the Subcommittee on Motion Sickness of the Committee on Medical Research a little dismayed, to put it politely. An enormous amount of time and energy had been spent on this problem during the war and much was accomplished. Also, many had the satisfaction of seeing or hearing of the results of their studies being successfully applied in landing operations. These studies, sponsored by the CMR, were the subject of numerous reports to the Surgeon General. They are also to be found in many easily available scientific and medical journals. I and, I am sure, any of the members of the wartime Subcommittee on Motion Sickness of the OSRDemr, would be glad to enlighten the Surgeon General's office on this matter.

DAVID B. TYLER

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In Criticism of Chisholm's "Social Responsibility"

If no workable plan for peace can be based on the anomalous idea that social processes are the outcome of individual attitudes and decisions, then a retort seems badly needed to the endorsement (*Science*, 1949, 109, 264) of the Chisholm article "Social Responsibility" (*Science*, 1949, 109, 27). This fallacious individualism leads to *der Fuehrerprinzip*—the belief that personal leadership by "mature" or "socially minded" persons is the basis of an orderly human society.

Much more space than this note can command should be given to serious refutation of such an idea. In a world in which "the poor always ye have with you," individual responsibility is a preoccupation with keeping the wolf from one's own door. If our social setup is working badly it is because the rules of the game are badly designed to encourage and reward this acceptance of personal responsibility for one's own welfare (see "Individualism; True and False," chapter in F. A. Hayek's *Individualism and the economic order*, 1948).

The spreading of the idea that science is an "endless frontier" which can provide for any number of *Homo sapiens*, all of whom can survive as winners in the game of life if we can develop a race of "brother keepers," obviously begets anything but good sportsmanship in the

morale of those who are not winning their way into the promised land of milk and honey. Such utopian materialism is directly responsible for the current war psychology, for we are eternally looking for a scapegoat—always the other fellow is this dog in the manger—when we couple personal responsibility with the fact that the promised land is not in sight.

From a truly impersonal, scientific angle, we'd do well to think through these Malthusian problems, starting from the observation of Boulding (*Sci. Mon.*, 1949, 68, 239) on the fallacies of composition and aggregation which obscure the fact that "the real world . . . cannot be understood by any generalization from individual experience." Note how this agrees with the contention of Leslie White (*J. Wash. Acad. Sc.*, 1947, 37, 181-210; also

Sci. Mon., 1948, 66, 235) that the individual is the creature, not the creator, of his culture; which leads us to the conclusion that "there is now only one basic importance in the world . . . on which the very existence of the race depends" (in the interest of the scientific spirit we must now reverse the Chisholm *ex cathedra* statement)—"the importance of an [un-]emotional relationship between the people of the world," based upon a justice that is blindfolded to persons and is using only an insensate mechanism. The last word has not been said on Adam Smith's "unseen hand," not even by Hayek in his masterful discussion of how the money-price system controls "The Use of Knowledge in Society" (*Amer. Ec. Rev.*, Sept. 1945).

ALDEN POTTER

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Association Affairs

The thirtieth annual meeting of the Pacific Division, AAAS, was held in Vancouver, Canada, June 13-16, with 37 registered members and guests in attendance. This, the first Canadian meeting of the Pacific Division, was held on the campus of the University of British Columbia, and inasmuch as it came between terms, it was possible to house the delegates in the living accommodations normally available to students.

Campus cafeterias and the Faculty Club provided excellent meals, and larger gatherings such as the general reception and the biologists' dinner were competently handled in Brock Memorial Hall. The University Extension looked after registration and assignment of rooms, dispensed information, provided projection equipment where and when needed, and took care of other miscellaneous problems as they turned up. All of this made for a compact, well-integrated meeting, and pointed to much foresight and excellent organization by the local committee.

Scenery is, perhaps, only an incidental adjunct of a scientific meeting. But it would be improper not to mention that the University of British Columbia occupies a location of breath-taking beauty, a promontory looking out across many square miles of seascape—Burrard Inlet and Howe Sound—to a backdrop of high, snow-covered mountains. The visitors were not too preoccupied with scientific matters to take note of this.

Forest ecologists had a chance to study forests. Sea-shore biologists went on a field trip at low tide. For fisheries, biologists, and oceanographers, the Canadian government made two boats available, one to demonstrate oceanographic equipment and methods, the other to demonstrate trawling.

There were three general evening sessions. At the first of these L. S. Cressman, of the University of Oregon, retiring president of the Pacific Division, gave an address on "Early Man in the Pacific Northwest." D. S. Dawson, of the University of Saskatchewan, spoke at the

second on "Scientific Fish Harvesting in Great Slave Lake." At the third, William J. Robbins, director of the New York Botanical Garden, discussed "Growth, Normal and Abnormal."

The Divisional Symposium, held Monday afternoon, June 13, had for its general subject, "Anthropology and its Applications to Society." David French, of Reed College, discussed "Anthropological Research in the War Relocation Authority"; H. G. Barnett spoke on "Social Research for Administrative Uses"; and R. F. Spencer, of the University of Minnesota, took for his topic "Immigrant Culture and Acculturation."

Another general symposium was arranged by the Pacific Science Board of the National Research Council on the general subject, "Research Plans for the Pacific Area, with Special Reference to the Seventh Pacific Science Congress." The speakers and their topics were: E. W. Gifford, University of California, "Anthropological Problems in Fiji"; Pierre Dansereau, University of Montreal, "Research Plans Developed at the Seventh Pacific Science Congress, Relating to Natural History and the Protection of Nature"; John P. Tully, Pacific Biological Station, Nanaimo, B. C., "Plans and Needs for Oceanographic Research as Discussed at the Seventh Pacific Science Congress"; R. C. Miller, director, California Academy of Sciences, "Some Problems of Population, Food and Available Resources in the Pacific Area."

The wide range of interests represented in this convention are well indicated by the symposia arranged by various societies on such topics as the following: "The Role of Chemistry in Pacific Northwest Industry," "Minor Element Nutrition in Western Soils," "Why Plants Grow Where They Do," "New Methods of High Speed Oceanographic Research," "Factors Influencing the Success of Reproduction in Anadromous and Shore Spawning Fishes," "Some Aspects of Fire in Natural Communities," "What Has Ecology Contributed to the Management of Natural Resources of the West?"

A circumstance much appreciated both by the Pacific Division and by the host institution was the presence throughout the meeting of the national president of the AAAS, E. C. Stakman, and the administrative secretary, Howard A. Meyerhoff. Through conferences, informal addresses, and meetings with the Council and the Executive Committee of the Pacific Division, they contributed greatly to the success of the meeting and to the permanent values to be derived from it.

The following societies, meeting in conjunction with the Pacific Division, held programs for the reading of scientific papers: American Chemical Society (Pacific Intersectional Division), American Meteorological Society, American Nature Study Society (Western Section), American Phytopathological Society (Pacific Division), American Society for Horticultural Science (Western Section), American Society of Ichthyologists and Herpetologists (Western Division), American Society of Lim-

nology and Oceanography, American Society of Plant Physiologists (Western Section), Association of Pacific Coast Geographers, Botanical Society of America (Pacific Section), Cooper Ornithological Club (Northern Division and Southern Division), Ecological Society of America (Western Section), Herpetologists' League, Pacific Northwest Bird and Mammal Society, Pacific Science Board of the National Research Council, Society for Experimental Biology and Medicine (Pacific Coast Branch), Society of American Bacteriologists (Southern California Branch), Western Society of Naturalists, and Western Society of Soil Science.

The British Columbia Academy of Science, an affiliated society of the AAAS, gave up its annual meeting for 1949 in order to participate more fully in the Vancouver meeting of the Pacific Division.

ROBERT C. MILLER

Secretary, Pacific Division, AAAS

Scientific Book Register

- ALBERT, ADRIAN. *Solid analytic geometry*. New York: McGraw-Hill, 1949. Pp. ix+162. \$3.00.
- ASHFORD, MAHLON. (Ed.) *Trends in medical education*. (New York Academy of Medicine, Institute on Medical Education, 1947). New York 22, N. Y.: Commonwealth Fund, 1949. Pp. xiv+320. \$3.00.
- BARLOW, H. M. *Micro-waves and wave guides*. New York 19, N. Y.: Dover Publs., 1949. Pp. x+122. (Illustrated.) \$1.95.
- BEGUN, S. J. *Magnetic recording*. New York (16), and Toronto: Murray Hill, 1949. Pp. x+242. (Illustrated.) \$5.00.
- BIRKHOFF, GARRETT. *Lattice theory*. (Rev. ed.) (American Mathematical Society Colloquium Publications, Vol. XXV.) New York: American Mathematical Society, 1948. Pp. xiii+283. \$6.00.
- BURK, R. E. and GRUMMITT, OLIVER. (Eds.) *Recent advances in analytical chemistry*. (Frontiers of Chemistry, Vol. VII.) New York: Interscience, 1949. Pp. vii+209. (Illustrated.) \$4.50.
- BURROW, TRIGANT. *The neurosis of man. An introduction to a science of human behavior*. New York: Harcourt, Brace, 1949. Pp. xxvi+428. (Illustrated.) \$7.50.
- CARINGTON, WHATELY. *Matter, mind, and meaning*. New Haven, Conn.: Yale Univ. Press, 1949. Pp. xx+257. \$3.75.
- FRIEDLANDER, GERHART, and KENNEDY, JOSEPH W. *Introduction to radiochemistry*. New York: John Wiley; London: Chapman & Hall, 1949. Pp. xiii+412. (Illustrated.) \$5.00.
- GATES, R. RUGGLES. *Pedigrees of negro families*. Philadelphia, Toronto: Blakiston, 1949. Pp. vii+267. (Illustrated.) \$5.50.
- LEIGHTON, ALEXANDER H. and DOROTHEA C. *Gregorio, the hand-trembler: a psychobiological personality study of a Navaho Indian*. (Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. XL-No. 1.) Cambridge, Mass.: Peabody Museum, 1949. Pp. xiv+177. \$2.50.
- LIND, L. R. (Trans.) *The epitome of Andreas Vesalius*. New York: Macmillan, 1949. Pp. xxxvi+103. (Illustrated.) \$7.50.
- MATSEN, F. A., MYERS, JACK, and HACKERMAN, NORMAN. *Pre-medical physical chemistry*. New York: Macmillan, 1949. Pp. viii+344. (Illustrated.) \$4.75.
- MERTON, EGON STEPHEN. *Science and imagination in Sir Thomas Browne*. New York: King's Crown Press, Columbia Univ., 1949. Pp. viii+156. \$2.50.
- NATIONAL HEALTH ASSEMBLY. *America's health: a report to the nation*. New York: Harper's, 1949. Pp. xiv+395. \$4.50.
- NONIDIZ, JOSE F., and WINDLE, WILLIAM F. *Textbook of histology*. New York: McGraw-Hill, 1949. Pp. xiii+456. (Illustrated.) \$6.75.
- RAPPAPORT, F. *Rapid microchemical methods for blood and CSF examinations*. New York 16, N. Y.: Grune & Stratton, 1949. Pp. xviii+404. (Illustrated.) \$8.75.
- REMICK, A. EDWARD. *Electronic interpretations of organic chemistry*. (2nd ed.) New York: John Wiley, 1949. Pp. vii+600. \$6.00.
- THORNDIKE, ROBERT L. *Personnel selection: test and measurement techniques*. New York: John Wiley; London: Chapman & Hall, 1949. Pp. viii+358. \$4.00.
- VAN HOOK, ANDREW. *Sugar: its production, technology and uses*. New York: Ronald Press, 1949. Pp. ix+155. (Illustrated.) \$3.00.

NEWS and Notes

Senator O'Mahoney's amendment to the independent offices appropriations bill HR 4177, calling for full FBI investigations of all fellows under the program of the Atomic Energy Commission (*Science*, July 22, p. 103), was approved by the Senate on August 2. The entire bill is now the subject of a Senate-House conference, but there seems to be no doubt that the amendment will be incorporated into the final act that is passed by both houses. Inasmuch as all recipients of fellowships must undergo investigation, the effect of the act will be to require investigation of all applicants. Whether, as reported in the July 25th issue of *Newsweek*, the National Research Council will decline to administer the AEC fellowships under these restrictions has not yet been learned.

About People

Joseph B. Platt, associate professor of physics at the University of Rochester, has been given a two-year leave of absence to serve as chief of the Physics Branch of the Research Division of the Atomic Energy Commission in Washington.

Harry C. Dyme, chief chemist at the Foundation of Applied Research, San Antonio, Texas, has accepted a position as chief of the Nutrition Unit of the Aero Medical Laboratory at Wright-Patterson Air Force Base, Dayton, Ohio.

George G. Manov has left the Radioactivity Section of the National Bureau of Standards to become chief of the Advisory Field Service Branch of the Isotopes Division of the Atomic Energy Commission, Oak Ridge, Tennessee.

H. B. Hungerford has retired as head of the Department of Entomology of the University of Kansas. Dr. Hungerford will continue his teaching and research, both at the

University of Kansas and, during summer months, at the University of Michigan Biological Station. He is replaced as chairman by Charles D. Michener.

Ruth Lofgren, assistant professor of bacteriology, University of Michigan, is guest investigator for the summer in the Microbiology Division, Scripps Institution of Oceanography, University of California, La Jolla, where she is studying the cytology of marine microorganisms.

Rudolph J. Pauly, director of the School of Pharmacy of the American University of Beirut, Lebanon, has been named assistant director of the Pharmaceutical Division of Sterling-Winthrop Research Institute, Rensselaer, New York.

Althea Revere, electron microscopy consultant, has been appointed associate professor of electron microscopy at the Graduate School of Stevens Institute of Technology, Hoboken, New Jersey.

N. T. Mattox has resigned as associate professor in zoology at Miami University, Oxford, Ohio, to accept a position as professor of biology at the College of Agriculture & Mechanic Arts of the University of Puerto Rico, Mayaguez, Puerto Rico. Dr. Mattox will organize and direct the founding of a marine biological research laboratory.

F. William Sunderman, head of the Department of Clinical Pathology at the Cleveland Clinic Foundation, has been appointed director of clinical research and head of the Department of Clinical Pathology at the University of Texas. Dr. Sunderman has also been appointed professor of experimental medicine and clinical pathology of the University of Texas Postgraduate School of Medicine.

Visitors to U. S.

Ch'ing-Sung Yü, formerly of the Nanking Observatory, is now conducting research as an associate on the staff of the High Altitude Observatory at Boulder, Colorado.

Recent visitors at the National Bureau of Standards included: the

Anglo-American Council on Productivity Simplified Practice Group, and Paul Vigoureux, British Admiralty Research Laboratory, Teddington, England.

Grants and Awards

The Actonian Prize of one hundred guineas has been awarded by the Royal Institution of London to Alexander Fleming for his work in penicillin. The prize has been awarded every seventh year since its establishment in 1938. Dr. Fleming recently visited medical institutions throughout the U. S. and attended the dedication exercises of the Oklahoma Medical Reserve Foundation in Oklahoma City.

The Society of Chemical Industry awarded its biennial gold medal to Foster Dee Snell, chemical consultant of New York, at its Manchester, England meeting. Dr. Snell is the second American to receive the award.

The Royal Photographic Society of Great Britain has elected Loyd A. Jones, head of the Physics Department at Kodak Research Laboratories, Rochester, New York, an honorary fellow. The society had honored Dr. Jones twice before this year, by the award of both its Progress Medal and its Hurter and Driffield Medal.

Fellowships

The John and Mary R. Markle Foundation invites deans of accredited medical schools in the United States and Canada to make nominations for the third group of Scholars in Medical Science on or before December 1. Each school may nominate one candidate. He should have completed the usual fellowship training in some area of science related to medicine and should hold, or expect to hold, in the academic year 1950-51, a full-time faculty appointment on the staff of a medical school. Grants of \$25,000 each, payable at the rate of \$5,000 annually, will be made to the schools over a five-year period.

The number of Scholars to be appointed in 1950 has not yet been

determined. Sixteen were chosen in 1948, and thirteen in 1949. A new booklet describing the plan, with suggestions for making application, is available on request from the Foundation, 14 Wall Street, New York 5, New York.

Industrial Laboratories

Schwarz Laboratories, Inc., 202 East 44th Street, New York 17, announces the availability of barium fructose-6-phosphate, dipotassium glucose-1-phosphate, and barium phosphoglyceric acid, three phosphorylated compounds used in studies of fermentation or enzyme reactions.

DuPont Company has begun construction in Philadelphia of a new \$2,000,000 building, to be known as the Marshall Laboratory. It will be four stories high and will house laboratory facilities for research in paints, varnishes, enamels, synthetic resins, and other finishing materials.

A fused phosphate fertilizer, especially suitable for use on magnesium-deficient soils, is now being produced on a commercial scale by **Manganese Products, Inc.**, at Seattle, Washington. The new fertilizer does not rot bags, requires no curing period, and is nonacid in its reaction.

Meetings and Elections

The **United Nations Scientific Conference on the Conservation and Utilization of Resources** will be held August 17–September 6 at Lake Success. Meetings will be held at 10:30 a.m. and 3:00 p.m. The full program follows: *August 17*, morning, plenary meeting, Introductory and Welcoming Addresses; afternoon, plenary meeting, The World Resources Situation; *August 18*, morning, plenary meeting, The World Resources Situation—A World Review of Critical Shortages; afternoon, plenary meeting, Using and Conserving Resources—Interdependence of Resources; *August 19*, morning, section meetings, New Techniques for Increasing Coal Production, The Appraisal of Water Resources, Forest Inventories, Methods of Soil Conservation, Storage

and Preservation of Agricultural Products; afternoon, plenary meeting, Using and Conserving Resources—Soils and Forests; *August 22*, morning, section meetings, Underground Gasification of Coal, Water Supply and Pollution Problems, Protection of Forests, Soil Conservation—Organization and Evaluation of Programs, Changes in Abundance of Fish Populations; afternoon, plenary meeting, Using and Conserving Resources—Fuels; *August 23*, morning, section meetings, Mineral Supplies and Their Measurement, Coal Carbonization, Comprehensive River Basin Development—A Symposium, Forest Management, Soil Surveys—Research in Relation to Soil Conservation; afternoon, plenary meeting, Using and Conserving Resources—Metals and Minerals; *August 24*, morning, section meetings, Increasing Mineral Resources by Discovery, New Techniques for Increasing Coal Production, Drainage Basin Management, Aids to Farming, Management and Cultivation of Fresh Water Fish; afternoon, plenary meeting, Creatable Resources: The Development of New Resources by Applied Technology; *August 25*, morning, section meetings, Conservation in Manufacture, Techniques of Oil and Gas Discovery and Production, Protective Functions of the Forests, Improving Soil Productivity, Fisheries Statistics; afternoon, plenary meeting, Methods of Resource Appraisal; *August 26*, morning, section meetings, Inorganic Fertilizers and Conservation, New Techniques for Increasing Production of Oil and Gas, Water Control Structures, Administration of Forests, Game and Fur Conservation; afternoon, plenary meeting, The Adaptation of Resource Programs; *August 29*, morning, section meetings, Oil Chemistry, Flood Control and Navigation, Logging and Sawmill Techniques, Seeding and Restoration of Natural Grazing Lands, Management of Wildlife Resources; afternoon, plenary meeting, Assessing Resources in Relation to Industrialization Plans; *August 30*, morning, section meetings, Conservation and Mining and Milling, Utilization of Energy, Irrigation

and Drainage, Protection of Crops and Grasslands, Livestock Breeding; afternoon, plenary meeting, Education for Conservation; *August 31*, morning, section meetings, The Outlook for Future Discovery—A Symposium, Utilization of Energy, Preservation and Chemical Utilization of Wood, Crop Policy and the Feeding of Livestock, Opportunities for the More Effective Use of New Agricultural Lands; afternoon, no meetings; *September 1*, morning, section meetings, Conservation by Corrosion Control, Utilization of Fuel, Hydro Power and Other Water Uses, Livestock Diseases and Tests, Research in the Conservation and Utilization of Marine Resources; afternoon, plenary meeting, Resource Techniques for Less Developed Countries; *September 2*, morning, section meetings, Conservation by Substitution, Plant Breeding, Condition of Grazing Lands, Developing Fishery Resources; afternoon, plenary meeting, Resource Techniques for Less Developed Countries—Labor and Public Health Techniques; *September 5*, morning, plenary meeting, The Integrated Development of River Basins—The Experience of the Tennessee Valley Authority; afternoon, plenary meeting, The Integrated Development of River Basins—A Symposium on Public Policy; *September 6*, morning, plenary meeting, Review of the Conference—A Symposium on Future Lines of Study and Directions for Progress; afternoon plenary meeting, Concluding Session.

A symposium on mineral nutrition of plants will be held at the University of Wisconsin on September 1–3. It will be followed on September 5–7 by a related symposium on plant growth substances.

The **Tenth Annual Research Conference of the Institutum Divi Thomae** and its affiliated units will be held in Cincinnati, September 6–8. Elton S. Cook, dean of research and head of the Division of Chemistry and Biochemistry, will act as general chairman. Reports will be presented on research in the fields of cancer, enzymes, growth, microbiology, and physics and physical chemistry.

The American Physiological Society will hold its regular fall meeting on September 14-17 at the Sheraton Bon Air Hotel and in the laboratories of the School of Medicine of the University of Georgia, Augusta.

A symposium on plasma proteins will be held in Chicago September 23-24 under the auspices of the University of Illinois College of Medicine and sponsorship of the Robert Gould Research Foundation. The foundation is at present devoting its funds primarily to support of scientific research in animal and human nutrition.

The Institute of Radio Engineers and the Radio Manufacturers' Association have appointed Donald G. Fink and John V. L. Hogan, fellows of the Institute of Radio Engineers, as chairman and vice chairman respectively of the Joint Technical Advisory Committee. Laurence G. Cumming, senior member of the Institute of Radio Engineers, was reappointed secretary of the committee. All three will serve for the term July 1, 1949-July 30, 1950.

The American Astronomical Society elected the following officers at its recent meeting in Ottawa: Alfred H. Joy, president; Dirk Brouwer, vice president; G. M. Clemence, G. P. Kuiper, and Andres McKellar, councilors. J. J. Nassau, treasurer, and C. M. Huffer, secretary, were re-elected.

The American Society for Engineering Education, at its annual convention at Rensselaer Polytechnic Institute, announced the election of the following new officers: president, Thorndike Saville, dean of engineering at New York University; vice presidents, B. J. Robertson, professor of mechanical engineering at the University of Minnesota; H. H. Armsby, specialist in engineering education, U. S. Office of Education; and F. E. Terman, dean of engineering at Stanford University.

An international symposium on morphogenesis was held under the auspices of the Centre National de La Recherche Scientifique in Strasbourg, France, July 4-12. The bo-

tanical and zoological part of the program had been organized by Drs. Gautheret (Paris) and Wolff (Strasbourg), respectively. The opening address on "The Future of Morphogenesis" was given by Paul Weiss (Chicago). Individual reports dealt with the following topics: vitamins in morphogenesis (Schopfer, Bern); estivation (David, Bordeaux); molecular problems of morphogenesis (Fauré-Frémiet, Paris); mechanisms of sea urchin development (Hoerstadt, Uppsala); rhizogenesis (Bouillenne, Liège); chemical regulation of plant organogenesis (Skoog, Wisconsin); correlations in plants (Champagnat, Strasbourg); regulation in amphibians (Daleq, Brussels); development of amphibian lens (Woerdemann, Amsterdam); phyllo-taxis (Plantefol, Paris); experimental morphogenesis in lower plants (Hurel, Paris); experimental embryology of *Tubifex* (Lehmann, Bern); experimental embryology of *Limnaea* (Raven, Utrecht); induction in avian development (Waddington, Edinburgh); regulation in avian development (Wolff, Strasbourg); tumor growth (White, Philadelphia); tissue culture and histogenesis (Gautheret, Paris); dedifferentiation in plants (Buvat, Paris); induction in annelid regeneration (Avel, Bordeaux); cell migration in planarian regeneration (Dubois, Strasbourg); development of flowers (Emberger, Montpellier). Participants report that the bilingual discussions brought ample proof of the need for close contact among botanists, zoologists, histologists, and biochemists in the analysis of morphogenesis. The harmonious spirit which prevailed during the conference augurs well for continued fruitful interchange among workers in this field on an international scale.

Deaths

Bernard E. Read, 62, acting director of the Henry Lester Institute in Shanghai, died in Shanghai on June 13. Dr. Read had taught and conducted research in China almost continuously since he went to Peiping Union Medical College in 1909 to head the Department of Pharmacology and Chemistry. He is the author

of the six-volume text *Chinese materia medica*. Since 1932 Dr. Read had been in Shanghai and was interned there during the war. He later reestablished the institute, which had been pillaged of its equipment by the Japanese.

Roy Selden Cook, 58, professor of chemistry and head of the Department of Chemistry of Mary Washington College of the University of Virginia, died of a heart attack on June 18 at Fredericksburg, Virginia.

Charles Alfred Weatherby, 73, research associate of the Gray Herbarium of Harvard University, died June 21 at his home in Cambridge, Massachusetts. Mr. Weatherby had served as a member of the International Commission on the Nomenclature of Plants since 1935 and was recently appointed a vice-president of the Section on Nomenclature of the International Botanical Congress to be held in Stockholm in 1950.

William Frederick Prouty, 69, head of the Department of Geology and Geography at the University of North Carolina, died June 27 of a heart attack. Dr. Prouty had done extensive research on the origin of the bays and lake basins of the Carolinas.

Robert A. Blum, 28, research associate of the Yerkes Laboratories of Primate Biology, Orange Park, Florida, with rank of assistant professor at Yale University, died June 30.

Alexander MacLeod Fraser, 42, professor of pharmacology at Dalhousie University Medical School, Halifax, Nova Scotia, died on July 8. Dr. Fraser had been at Dalhousie less than a year and previously he had held the rank of assistant professor at McGill University. During World War II he was engaged in the study of the physiology of high altitudes.

Wallace W. Atwood, 76, president emeritus of Clark University, Worcester, Massachusetts, died July 24. Dr. Atwood was professor of physiography at Harvard University from 1913 to 1920. He founded the Clark School of Geography and directed it until his retirement.

Plans have been announced for publication of the **Proceedings of the Seventh Pacific Science Congress**, held in New Zealand in February. It is expected that the printing will be completed by March, 1950. The six volumes—which comprise general proceedings; geology, geophysics and volcanology; meteorology and oceanography; zoology; botany and soil resources, agriculture and forestry; and anthropology—will be sold at a total estimated cost of \$26.80, or as single volumes. The larger the initial order for printing, the lower the cost of the individual volumes will be. Early registration, therefore, with the Secretary-General, Pacific Science Congress, Box 27, Newmarket, Auckland S. E. 1, New Zealand, will contribute to lowering the cost. Complimentary copies of the proceedings will be available only to official members of the congress.

The Hall of Comparative Anatomy of the **American Museum of Natural History** has placed on exhibit a domestic donkey, last mounted specimen of the late S. Harmsted Chubb, who at the time of his death on May 6, 1949, was associate curator emeritus of comparative anatomy. Dr. Chubb had developed a realistic technique for mounting animals to show their characteristic action. The entire collection of his specimens, prepared during his forty-eight years at the Museum, will remain on permanent display there.

The **Director of Translators and the Translations Pool** (see *Science*, June 10, page 601) are now both under the sponsorship of the entire Special Libraries Association located at the Southwest Research Institute in San Antonio, Texas. The expanded services of the Translations Pool now include cards for 13,000 translations.

Studies in Air Hygiene, a report on the techniques for reducing airborne bacterial contamination through the use of filters, ventilating equipment, and chemical sprays, is now available. The report, published by the British Medical Research Council, discusses various instruments for sampling air; chemical,

ultraviolet, heat, and filtration methods of air disinfection; field studies of air contamination in public places, homes, factories, and warships; and various air disinfection methods now available. The report may be obtained from British Information Services, 30 Rockefeller Plaza, New York 20, New York, at \$2.35.

The **Veterans Administration Hospital at Hines, Illinois** is seeking a biochemist for its recently established neuropsychiatric laboratory. It is preferable that the applicant have a Ph.D. and experience in medical research. The starting salary for this position is \$5,232 a year, with periodic increases up to a maximum of \$6,235.

The **Southern Association of Science and Industry** has adopted as its official publication the new *Journal of Southern Research*. The journal contains a section reviewing technical works of Southern authors, a page listing patents issued to Southern inventors, and a news section devoted to the activities of Southern scientists.

Recently Received—

International Council of Scientific Unions, report of the Executive Committee for 1948. Printed at the University Press, Cambridge, England. Price 5s.

Nutrition Surveys: Their Techniques and Value. (NRC bull. 117). Published by the National Research Council, National Academy of Sciences, Wash. 25, D. C. Price \$1.50.

Vertebrate Embryology by Richard M. Eakin. (University of California Syllabus Series No. 314). University of California Press, Berkeley and Los Angeles. \$1.25.

"Murex Limited" (descriptive booklet outlining availability and industrial uses of Murex metallurgical and chemical products). Murex Ltd., Rainham, Essex, England.

Proceedings of the Auburn Conference on Statistics Applied to Research in the Social Sciences, Plant Sciences, and Animal Sciences, September 7-9, 1948. Sta-

tistical Laboratory, Alabama Polytechnic Institute, Auburn, Alabama.

Tracts for Computers: Random Normal Deviates, by Herman Wold. (No. XXV.) Cambridge Univ. Press, 51 Madison Avenue, New York 10, N. Y. \$1.25.

Nuclear Instrument Handbook. (Reprinted from *Nucleonics*.) McGraw-Hill Publishing Co., New York 18, N. Y.

Cinchona Review edited by Albert Hemming. Cinchona Products Institute, Inc., New York, N. Y.

Right of Way Maintenance by Plant-Community Management by Frank E. Egler. Copies available from Conn. Tree Protective Association, Waterbury 84, Conn. at 30¢.

Proceedings of the Federal Inter-Agency Sedimentation Conference (held at the Bureau of Reclamation Laboratories, Denver, Colorado, May 6-8, 1947). Prepared for publication by the Bureau of Reclamation, U. S. Dept. of the Interior, Washington, D. C., from which copies are available for limited distribution.

Electronique Magnetonique et Radiation by Maurice Ducharme. Montreal Radio College, Montreal, Canada.

Conference on Metabolic Aspects of Convalescence: (1) Transactions of the Sixteenth Meeting, New York, October 27-28, 1947, (2) Transactions of the Seventeenth Meeting, New York, March 29-30, 1948. Available from Josiah Macy, Jr. Foundation, New York 21, N. Y. at \$3.00 and \$4.00 respectively.

Make Plans for—

Conference on Low Temperature Calorimetry, September 10, Massachusetts Institute of Technology, Cambridge.

American Chemical Society, 116th national meeting, September 18-23, Atlantic City, New Jersey.

Illuminating Engineering Society, national technical conference, September 19-23, French Lick, Indiana.